Article   Open Access

Impact of Women Driving Rights on Adoption and Usage of E-hailing Applications in Saudi Arabia

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Abstract

E-hailing applications are becoming popular around the globe. However, the motivations and barriers to use these applications may differ in different countries. Therefore, the aim of current work is to explore noteworthy factors affecting the acceptance of the e-hailing application 'Careem' in the context of Saudi Arabia. Due to recent driving permission given to women in Saudi Arabia and the lesser acceptance of public transport in Saudi Arabia, this study is of fundamental importance. To achieve the purpose of this study, the technology acceptance model is extended by adding external variables: perceived convenience, perceived accessibility and confirmation. Careem application users participated in a survey that was created and circulated to acquire measurement of the factors. The data gathered from 428 users are analysed using structural equation modelling. The findings show that perceived usability, perceived ease of use, perceived usefulness and perceived convenience are crucial and direct predictors of intention to use e-hailing applications, while confirmation and perceived accessibility are discovered to be factors that have an impact on the intention to use e-hailing applications. The findings of the study highlight the significant contributing factors in the adoption and usage of e-hailing applications. Also, these factors can assist designers and developers of these applications to develop applications having high acceptance and usage.

Keywords

E-hailing applications; Acceptance of E-hailing applications; Technology acceptance model.

1   Introduction

The Kingdom of Saudi Arabia's Vision 2030 aspires to variegate the economy of the country from oil production and targeting a sustainable economic foundation (Al-Garawi & Kamargianni, 2022). The reforms proposed in the Vision 2030 are directed towards finding alternative sources of economic growth. The aim of the Vision 2030 is to make the economy of Saudi Arabia sustainable and solid (Hvidt, 2018). In mid-2020, the total population of the Kingdom of Saudi Arabia is 35 million (20 million men, 15 million women). According to the employment statistics in the second quarter of 2021, the total employment in the KSA is approximately 13.4 million, including 3.3 million Saudi nationals and 10.2 million non-Saudis. From the gender point of view, 10.5 million men and 2.4 million women are employed in the KSA. The Vision 2030 promotes women to the job market by requesting public sector organizations to create jobs for women. In September 2017, the right for women to drive was restored to enhance the proportion of women in the workforce (Hvidt, 2018). Before this, women usually travelled with an adult male household member or with an employed driver or by taxis for education, shopping and jobs (Aldalbahi & Walker, 2015; Alotaibi & Potoglou, 2018). However, if a woman is traveling with her adult male relative, it forces him to take leave from his job; on the other hand, employing a driver poses a financial burden on the family. Due to these problems, women are also using traditional taxis and travel using e-hailing/ride-hailing applications. The positive aspects of these applications are less meeting time, accessibility, enhanced communication, less searching time, convenience and easy payment (Cheng & Huang, 2013). In a short time, these applications have been adopted in different countries around the globe and affected the economy of each country as well as the global economy.

Mobile applications are getting significant research and industry attention and these applications are targeting almost all fields of life, for instance, e-health, e-banking, e-shopping and e-library (Cheng & Huang, 2013; Rafique et al., 2020; Rafique et al., 2018; Shamim et al., 2021). At present, these applications are playing an important part in the field of transport by introducing e-hailing applications (EHA) such as Grab Car, Uber, Hailo and Careem (He & Shen, 2015). With a market share of more than 50% in 2018 (Grandview Research, 2022), e-hailing is the largest segment of the worldwide ride-hailing industry. The expected revenue generated globally in 2020 by the ride-hailing sector is approximately USD 216 billion, which will result in USD 318 billion of market volume by 2023 with an annual growth rate of 13.7% (Grandview Research, 2022; Statista.com, 2022). This revenue was only USD 34.45 billion in 2018 (Grandview Research, 2022). The user penetration rate in 2020 is 15.4% and is expected to reach 20.0% by 2023 worldwide (Grandview Research, 2022; Statista.com, 2022). EHA are widely used in big cities of Saudi Arabia and the number of users of these applications is growing day by day. In the context of Saudi Arabia, the user penetration rate of EHA is 13.9% in 2020, and a 17.7% rate is anticipated by 2023. There is little difference between the global and Saudi Arabian user penetration rates of the ride-hailing sector. This user penetration rate resulted in USD 827 million revenue generated by the ride-hailing sector in Saudi Arabia. Additionally, the annual expected growth rate is 14.3%, which will result in USD 1,236 million market volume by 2023 (Grandview Research, 2022; Statista.com, 2022). The expected increases in the usage of EHA, market volume and user penetration rate show the significance of EHA in the context of Saudi Arabia. Therefore, this study targeted the EHA to deeply understand the factors playing a significant part in the usage and adoption of these applications. The outcomes of this study will aid to create more sophisticated and user-friendly applications that considerably contribute to the economy of Saudi Arabia.

The positive aspects of these applications are the facilities they offer in the transport sector. On the other hand, there are some concerns about the adoption of these applications. Also, there are numerous factors that may affect the usage and adoption of e-hailing applications (Shamim et al., 2021). That said, the motivations and barriers to use these applications may differ around the globe. However, limited research focusing on the acceptance of EHA has been conducted, especially in the context of Saudi Arabia after the

permission to drive has been granted to women. Therefore, this work aims to study the acceptance of EHA empirically and to investigate the impact of women driving rights on the adoption and usage of e-hailing applications in Saudi Arabia. Mostly, women in Saudi Arabia use EHA for the confirmation, accessibility and convenience due to lack of public transport. That is why we selected perceived convenience, perceived accessibility and confirmation as factors to be explored in this study. Consequently, the technology acceptance model (TAM) is selected and expanded with external variables (perceived convenience, perceived accessibility and confirmation) to investigate the Careem application users' behaviour in the Kingdom of Saudi Arabia. However, the importance of this study has drastically increased in the context of Saudi Arabia due to the lack of public transport and driving rights recently given to women in Saudi Arabia. Currently, many users are using the Careem application around the globe. To fulfil the aim of the current work, data are collected from the users of the Careem application using a questionnaire survey, and then the collected data are examined using structural equation modelling. The study findings highlight the significant factors that contribute to the adoption and usage of EHA. Besides, these highlighted factors can assist designers and developers of these applications to develop applications with high acceptance and usage. Additionally, the current study discovers factors that result in low adoption and usage of EHA.

This paper consists of six sections. Existing literature related to technology acceptance models and EHA is presented in Section 2. Section 3 discusses the proposed research model and hypothesis. Section 4 presents the research methodology. Section 5 exhibits the results. Section 6 highlighted the research contributions and implications. The research work is concluded in Section 7.

2 Literature review

2.1 Technology acceptance models

In literature, various models and theories have been presented to explore the factors affecting the aim to use information systems, namely, the theory of reasoned action (TRA), the theory of planned behaviour (TPB) and the technology acceptance model (TAM). Ajzen and Fishbein proposed the TRA in the 1970s (Fishbein & Ajzen, 1975). It extends information integration theory by introducing the perceived behavioural control variable. The TRA is found to be effective in predicting people's behaviour across many populations and contexts (Hagger, 2019). In the TRA, human behaviour is expected and clarified using three elements: attitudes, subjective norms and intentions. The role of cognitive deliberation, habit, misunderstanding and moral factors are missing in the TRA. Additionally, the validation of the TRA is a critical issue due to usage voluntariness (Taherdoost, 2018). The TPB extended the TRA and consists of three factors: subjective norm, attitude and perceived behavioural control. The first factor is the attitude towards the behaviour, which is the individual reactions to certain objects in the environment. The second factor is the subjective norm, which is the view of a person's comprehension of what is relevant to others. The third factor is perceived behavioural control, specified as a condition where individuals consider that behaviour is easy or difficult to deal with. The TAM is one of the most powerful models to determine the acceptance of information systems (IS). It was proposed in 1984 (Davis, 1989). It is derived from the TRA. It is famous for its use to predict the intention to utilize changeable technologies. The TAM has two core constructs: perceived usability (PU) and perceived ease of use (PEOU). These two constructs influence the use of the system by its users. PU is defined as "the degree to which an individual trusts that using a specific system would improve their job performance" and PEOU is defined as "the degree to which an individual trusts that a specific system would be free from effort" (Davis, 1989). The TAM was applied widely to investigate users' intention to use new technologies by pinpointing factors affecting the acceptance of technology in various domains and contexts, including online banking (Lule et al., 2012; Mortimer et al., 2015), digital libraries (Rafique et al., 2020; Rafique et al., 2018), mobile payment (Di Pietro et al., 2015), mobile applications (Kwon et al., 2013), mobile learning (Gan et al., 2017) and e-learning

(Rafique et al., 2023). The TAM has also been applied in the transport sector to investigate users' behaviour towards new technology. A comparison of the above-mentioned models is presented in Table 1.

Table 1. *Comparison of existing technology acceptance models.*

Models	Factors					
	Behaviour intention	Attitude	Subjective norm	Perceived behavioural control	Perceived ease of use	Perceived usefulness
TRA	✓	✓	✓	×	×	×
TPB	✓	✓	✓	✓	×	×
TAM	✓	×	×	×	✓	✓

2.2 Related work

The acceptance of transport applications is studied in diverse geographical regions, including China (H. Li & Liu, 2014; Park & Kim, 2014; Y. Wang et al., 2018; Zhou, 2012), Brazil (Joia & Altieri, 2017), Malaysia (Lim et al., 2018; Ubaidillah et al., 2019; Weng et al., 2017), France and Switzerland (Madigan et al., 2016), Vietnam (Giang et al., 2017), Thailand (Ruangkanjanases & Techapoolphol, 2018), Indonesia (Gumilar et al., 2019), India (Ardra & Rejikumar, 2017), and Taiwan (Cheng & Huang, 2013). These studies have measured the acceptance of transport applications by utilizing and extending different models according to context and domain as presented in Table 2. Table 3 shows the factors from previous studies that are relevant to the transport sector.

Table 2. *Models used in existing studies.*

No.	Models	Existing studies
1	TAM	(Azmi et al., 2016; Cheng & Huang, 2013; Park & Kim, 2014; Sinaga & Hendayani, 2015; Y. Wang et al., 2018; Xu, Zhang, & Ling, 2008)
2	TAM, UTAUT, DOI	(Di Pietro et al., 2015)
3	TAM, ECT	(H. Li & Liu, 2014)
4	TCT (TAM, ECM and COGM)	(Weng et al., 2017)
5	UTAUT	(Madigan et al., 2016; Osswald, Wurhofer, Trösterer, Beck, & Tscheligi, 2012; Zhou, 2012)
6	UTAUT2	(Chen & Salmanian, 2017)
7	UTAUT2, DOI	(Yeap, Yapp, & Balakrishna, 2017)
8	ACSI, PSI	(Shen, Xiao, & Wang, 2016)
9	TRA, TPB, TRI, TAM	(Joia & Altieri, 2017)
10	DOI, TAM	(Ruangkanjanases & Techapoolphol, 2018)

A study was conducted to discover the adoption factors of the Uber application in India targeting 186 female users without a driving license (Ardra & Rejikumar, 2017). The study spotlighted four main adoption factors, namely PEOU, safety, usefulness and price after performing a data analysis with the help of structural equation modelling. Joia & Altieri (2017) examined the acceptance of an e-hailing application using IDT and TAM in Brazil. The data collection method was an online survey. Subjective norm, perceived ease of use, perceived usefulness, complexity, compatibility, relative advantage, trust and satisfaction were found to be promising influential factors. Their findings showed a correlation between perceived usefulness and user pleasure that was positive. Lim et al. (2018) found an important relationship

of PU, subjective norms, perceived risk and perceived playfulness with the consumers' adoption of ride-hailing applications in the context of Malaysia. Table 4 presents a summary of existing studies in the area of transport applications.

Table 3. Extracted factors of existing studies.

No.	Influencing factors	Existing studies
1	Perceived ease of use	(Ardra & Rejikumar, 2017; Di Pietro et al., 2015; Giang et al., 2017; Joia & Altieri, 2017; Park & Kim, 2014; Ruangkanjanases & Techapoolphol, 2018; Weng et al., 2017; Xu et al., 2008)
2	Perceived usefulness	(Ardra & Rejikumar, 2017; Cheng & Huang, 2013; Di Pietro et al., 2015; Giang et al., 2017; Joia & Altieri, 2017; H. Li & Liu, 2014; Park & Kim, 2014; Sinaga & Hendayani, 2015; Y. Wang et al., 2018; Weng et al., 2017; Xu et al., 2008)
3	Perceived safety	(Ardra & Rejikumar, 2017; Azmi et al., 2016; Osswald et al., 2012; Shen et al., 2016)
4	Perceived price	(Amirkiaee & Evangelopoulos, 2018; Ardra & Rejikumar, 2017; Azmi et al., 2016; Shen et al., 2016; Yeap et al., 2017)
5	Perceived convenience	(Azmi et al., 2016; Shen et al., 2016)
6	Perceived accessibility	(Azmi et al., 2016)
7	Perceived risk	(Cheng & Huang, 2013; Y. Wang et al., 2018; Weng et al., 2017; Yeap et al., 2017; Zhou, 2012)
8	Compatibility	(Di Pietro et al., 2015; Joia & Altieri, 2017; Yeap et al., 2017)
9	Security	(Di Pietro et al., 2015; Ruangkanjanases & Techapoolphol, 2018; Shen et al., 2016)
10	Perceived locational accuracy	(Park & Kim, 2014; Shen et al., 2016)
11	Time benefit	(Amirkiaee & Evangelopoulos, 2018)
12	Effort expectancy	(Madigan et al., 2016; Osswald et al., 2012; Yeap et al., 2017; Zhou, 2012)
13	Social influence	(Amirkiaee & Evangelopoulos, 2018; Madigan et al., 2016; Osswald et al., 2012; Ruangkanjanases & Techapoolphol, 2018; Yeap et al., 2017; Zhou, 2012)
14	Privacy concern	(Yeap et al., 2017; Zhou, 2012)
15	Facilitating conditions	(Osswald et al., 2012; Shen et al., 2016; Yeap et al., 2017; Zhou, 2012)
16	Complexity	(Joia & Altieri, 2017)
17	Relative advantage	(Joia & Altieri, 2017; Ruangkanjanases & Techapoolphol, 2018)
18	Trialability	(Ruangkanjanases & Techapoolphol, 2018)
19	Trust	(Amirkiaee & Evangelopoulos, 2018; Joia & Altieri, 2017; Zhou, 2012)
20	Anxiety	(Amirkiaee & Evangelopoulos, 2018; Osswald et al., 2012)
21	Personal innovativeness	(Cheng & Huang, 2013; Sinaga & Hendayani, 2015; Y. Wang et al., 2018; Yeap et al., 2017)
22	Behavioural intention	(Cheng & Huang, 2013; Di Pietro et al., 2015; H. Li & Liu, 2014; Madigan et al., 2016; Osswald et al., 2012; Park & Kim, 2014; Sinaga & Hendayani, 2015; Y. Wang et al., 2018; Yeap et al., 2017; Zhou, 2012)
23	Attitude towards using	(Amirkiaee & Evangelopoulos, 2018; Giang et al., 2017; Osswald et al., 2012; Park & Kim, 2014; Sinaga & Hendayani, 2015; Weng et al., 2017; Xu et al., 2008)
24	Satisfaction	(H. Li & Liu, 2014; Park & Kim, 2014; Weng et al., 2017)
25	Confirmation	(H. Li & Liu, 2014; Weng et al., 2017)

No.	Influencing factors	Existing studies
26	Subjective norm	(Giang et al., 2017; Joia & Altieri, 2017)
27	Performance expectancy	(Madigan et al., 2016; Osswald et al., 2012; Yeap et al., 2017; Zhou, 2012)
28	Immediacy	(Yeap et al., 2017)
29	Hedonic motivation	(Yeap et al., 2017)
30	Self-efficacy	(Osswald et al., 2012)
31	Sustainability concern	(Amirkiaee & Evangelopoulos, 2018)
32	Reciprocity	(Amirkiaee & Evangelopoulos, 2018)
33	Altruism	(Amirkiaee & Evangelopoulos, 2018)

Table 4. Related work.

Reference	Domain	Context	Findings
(Ubaidillah et al., 2019)	E-hailing applications	Malaysia	PP is an important determinant of intention to use e-hailing app.
(Ruangkanjanases & Techapoolphol, 2018)	E-Hailing applications	Thailand	PEOU and relative advantage affect the decision to utilize EHA.
(Z. Li et al., 2021)	E-Hailing applications	Brazil	Perceived usefulness and user satisfaction are positively related with each other.
(Ardra & Rejikumar, 2017)	E-hailing applications	India	PEOU, PU, perceived price, perceived safety, and advantage impact behavioural intention.
(Giang et al., 2017)	Ridesharing applications	Vietnam	Attitude is positively influenced by PU and PEOU.
(Y. Wang et al., 2018)	Ridesharing service	China	Perceived risk and perceived usefulness are associated negatively with each other.
(Gumilar et al., 2019)	Ride-hailing	Indonesia	Perceived utility is negatively correlated with perceived risk.
(Lim et al., 2018)	Ride-hailing	Malaysia	PU and PR have a relationship with the intention to use ride-hailing applications.
(H. Li et al., 2014)	Online travel services	China	The intention to use online travel services is influenced by perceived usefulness and user satisfaction.
(Weng et al., 2017)	Mobile taxi application	Malaysia	Attitude, satisfaction and PU are found to be vital factors in the usage of mobile taxi application.
(Zhou, 2012)	Location-based services	China	PEOU, PU and trust are positively related with intentions to use.
(Madigan et al., 2016)	Road transport systems	France and Switzerland	Effort expectancy, performance expectancy and social influence have an impact on the behavioural intention.

Reference	Domain	Context	Findings
(Cheng & Huang, 2013)	Mobile ticketing	Taiwan	The likelihood of using mobile ticketing applications and the perceptions of risk (PU, PEOU) are related.
(Park & Kim, 2014)	Car navigation systems	China	Service and display quality, perceived processing speed, customer satisfaction and perceived locational accuracy are the factors that influence the intention to use car navigation systems.

The above discussion highlighted the focus of current research in the domain of transport, particularly for e-hailing applications. Therefore, the current work will expand the existing literature on e-hailing applications by investigating the acceptance of the Careem application in the Saudi Arabian context.

3   Proposed Model and Hypotheses

A research model based on the TAM is proposed in this study where Saudi Arabia was chosen as the study context and the scope of the research is defined in terms of an e-hailing application (Careem). The TAM is extended on the basis of literature review, context and scope of the research by adding external factors, namely perceived convenience, perceived accessibility and perceived confirmation as shown in Figure 1. The TAM is selected as a base model due to its simplicity, parsimony and robustness.
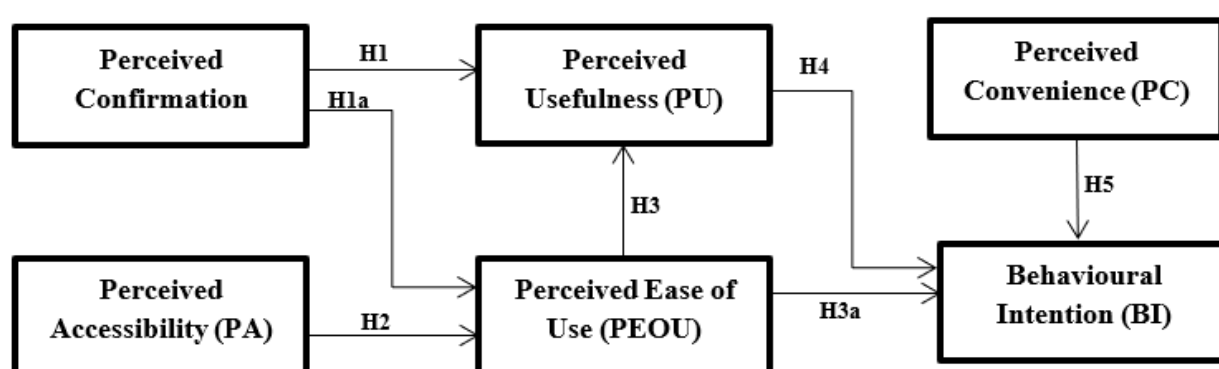

Figure 1. Proposed research model.

3.1   Confirmation (C)

Confirmation is defined as "the extent to which individuals realize their expected benefits during their past experience" (M.-M. Wang & Wang, 2019). Confirmation is considered "a cognitive notion referring to the degree that the actual use of the IS reflects the expected use of the information system"(Weng et al., 2017). Users have some initial expectations about EHA before use. Users create their perceptions about the performance of EHA based on their experiences and set their confirmation by comparing the performance of EHA and initial expectations. The confirmation, usage experience and initial expectations derive the usefulness of product or service, which in turn affects behavioural intention (M. M. Wang & Wang, 2019). Confirmation is used to modify the PU when the usefulness of a product or service is overlooked due to uncertainty about expected output (Bhattacherjee, 2001). For example, at the start of EHA, users might perceive low usefulness; however, the usefulness might be adjusted based on the confirmation level and expectations. Specifically, confirmation increases the degree of perceived usefulness while discomfort reduces the degree of perceived usefulness (Weng et al., 2017). Bhattacherjee (2001) and Weng et al. (2017) have suggested a positive association between confirmation and perceived usefulness. Existing literature

has also proved that the degree of confirmation has an impact on PEOU (Bhattacherjee et al., 2008; Hong et al., 2006; Lin et al., 2007; Thong et al., 2006). Therefore, the following hypotheses are proposed.

H1: Confirming user expectations of the EHA positively affects the EHA's PU.

H1a: The PEOU of the EHA is benefited by user expectations of the EHA being confirmed.

3.2 Perceived accessibility (PA)

PA is described as the ease of reaching goods, services, destinations and activities, and it is the goal of most transport services (Litman, 2008). Furthermore, PA is "the extent which enables a group of individuals to reach destination or activities through transport modes" (Geurs & Ritsema van Eck, 2001). Particularly, PA refers to "people's ability to get to or arrive at destinations, services or opportunities using transport" (Albacete et al., 2015). Rafique et al. (2018) reported a strong correlation between PA and PEOU. In the transport sector, the impact of accessibility is critical to customers' intentions as users will always incline to select services that are accessible to reach their preferred destination (Teo et al., 2018). Therefore, H2 is developed as:

H2: PA has a positive effect on the PEOU of the EHA.

3.3 Perceived ease of use (PEOU)

PEOU is "the degree to which an individual perceives the asserted effort in using the application" (Davis et al., 1989). Easy-to-use applications positively affect the intention to use the EHA. Davis (1989) described the influence of PEOU on PU in the TAM. Furthermore, this influence was confirmed in the ECT by Oliver (1980). PEOU has an impact on PU in ride-sharing applications as highlighted by Y. Wang et al. (2018). Joia & Altieri (2017) also reported the same relationship in the context of Brazil. Consequently, the higher the perceived ease of use is, the higher the perceived usefulness will be. Based on the findings of Joia & Altieri (2017) and Y. Wang et al. (2018), the following hypotheses are proposed:

H3: PEOU of EHA has a positive impact on PU.

H3a: PEOU of EHA has a positive impact on BI.

3.4 Perceived usefulness (PU)

PU is characterized as "the degree to which a person trusts that using a specific system would improve their job performance" (Davis, 1989). Y. Wang et al. (2018) showed the impact of perceived usefulness on the usage and adoption of ride-sharing applications. The association between PU and BI was highlighted in car navigation systems (Park & Kim, 2014). On the other hand, the relationship of BI and PU has not been identified by Joia & Altieri (2017) or Y. Wang et al. (2018). We therefore formulate the following hypothesis:

H4: PU has a positive influence on BI of EHA.

3.5 Perceived convenience (PC)

PC is described as a situation where "users believe that a technology or a system is helpful to their task completion"(Chang et al., 2012). Ride-sharing services focus to facilitate users in terms of convenience, accessibility and safe mode of transport (Teo et al., 2018). If a product or service saves time for users, then it is considered convenient (Chang et al., 2012). Therefore, EHA are considered to be convenience for users. Furthermore, by using EHA, users find it convenient to book a ride, increasing the usefulness of EHA. A previous study on the e-hailing application Grab revealed a significant relationship between PC and BI (Teo et al., 2018). Furthermore, one of the main reasons behind a customer's intention to use an e-hailing application is the convenience it provides in terms of traffic jams (Z. Li et al., 2021), ease of payment (Rayle et al., 2016), travel in urban areas (Alley, 2016), less waiting and hailing time (Rayle et al., 2016), time and

money (Carranza et al., 2016). Therefore, this study extends the TAM with PC as an external factor by exploring the impact of PC on PU. Besides, hypothesis H5 is as follows:

H5: PC has a positive impact on BI of EHA.

3.6 Behavioural intention (BI)

Behavioural intention can be measured using the acceptance of the system (Davis et al., 1989). In technology acceptance studies, user behaviour can be identified by usage intentions. A strong connection between behaviour and intention was highlighted by Mathieson et al. (2001). Moreover, the intention is the immediate ancestor of behaviour (Szajna, 1996). Existing research shows a significant relationship between PEOU and PU and behavioural intention. BI is therefore chosen in our analysis as a dependent variable.

4 Research Methodology

4.1 Questionnaire development

A questionnaire is designed and developed based on existing studies to ensure the validity and reliability of the questionnaire. The questionnaire consists of two parts. The first part is related to demographic information (age, gender and use of EHA) and questions related to six selected factors are asked in the second part. The influence of selected features is measured employing a 5-point Likert scale. The items of PU (Rafique et al., 2018), PEOU (Rafique et al., 2018), PC (Chang et al., 2012), PA (Rafique et al., 2018) and confirmation (Weng et al., 2017) are adapted from existing literature. Five items are associated with PU, four items are related to PEOU and C, whereas three items are linked with BI, PC and PA. Behaviour intention is considered the dependent variable while PEOU, PU, PC, PA and C are the independent variables.

4.2 Data collection

The questionnaire survey was performed in the context of Saudi Arabia, where e-hailing applications are commonly accepted. Different users of EHA from different cities of Saudi Arabia participated in the survey. The targeted users were encouraged to fill in the questionnaire and asked to provide their agreement level from strongly agree to strongly disagree. Both online and offline media were utilized to distribute the questionnaire to users of e-hailing applications. The survey received responses from 428 participants in total. Table 5 shows the respondents' details.

Table 5. Respondent details.

	Categories	Frequency	Percentage
Gender	Male	214	50%
	Female	214	50%
Age	Less than 25	279	65%
	26-35	99	23%
	36-45	26	6%
	Above 45	24	6%
Income	Less than 5,000	186	44%
	5,000-10,000	142	33%
	More than 10,000	100	23%

4.3 Data analysis

The Statistical Package for Social Science (SPSSv20) and analysis of moment structure were used to analyse the data (AMOS v20). SPSS was used for data cleaning, data coding and factor analysis. Factor analysis was done through confirmatory factor analysis (CFA) and exploratory factor analysis (EFA). CFA was used for the validation and testing of the constructs and proposed hypotheses with the SEM (structure equation model). SEM was used to describe the relationship between multiple dependent and independent variables. It also provided the mechanism to validate and test the relationship of constructs in the model. A measurement model (MM) and a structural model (SM) were the two parts of the SEM. While the given hypothesis was tested using the structural model, the measurement model tested the validity, reliability and goodness-of-fit indices. AMOS performed the measurements and structural models.

5 Results and Discussion

To purify the observed items, EFA was conducted by using SPSS. The Kaiser-Mayer Olkin Measure of sampling adequacy and Bartlett's test of sphericity were performed for the EFA. The obtained results showed that KMO = 0.943 while Bartlett's test showed $p < 0.001$. Principal component analysis was used as the extraction method, and Varimax with Kaiser normalization was used as the rotation method. Factor loading values above 0.6 were considered.

5.1 Measurement model

After the extraction of factors, the MM was performed to validate the relationship between items (variables) and factors (constructs). The MM was assessed using CFA and its validation was accomplished with reliability and validity (Hair, Black, Babin, & Anderson et al., 2010). Factor loading is an indicator of reliability. Factor loading values were greater than, 0.7 indicating the reliability of constructs as recommended by Hair et al. (2010). Validity is accessed through discriminant and convergent validity. Average variance extracted (AVE) and composite reliability (CR) calculations can be used to quantify convergence validity. Table 6 shows that the CR of each factor is above the threshold value of 0.7 recommended by Straub et al. (2004). Furthermore, the AVE values are greater than 0.5. Therefore, CR and AVE values exhibit the relationship between all items of each factor. The CR of each construct is more than 0.6, which shows strong reliability. The statistical representation of data in Tables 6, 7 and 8 shows the adequacy of data through the MM. Moreover, the Cronbach's alpha value is acceptable as it is above 0.70. The Cronbach's alpha of the questionnaire is 0.974, which is above the acceptable value (0.70). In the measurement of model fit, three types of fit are considered: absolute, incremental and parsimonious. The values of these models exhibit that the MM fits the data satisfactorily (see Table 8).

Table 6. Item loadings, CR, AVE and alpha values.

Constructs	Items	Factor loading	CR	AVE	Cronbach's alpha
BI	BI1	0.70	0.87	0.69	0.913
	BI2	0.85			
	BI3	0.93			
PEOU	PEOU1	0.75	0.83	0.62	0.62
	PEOU3	0.89			
	PEOU4	0.71			
PU	PU1	0.81	0.83	0.63	0.898
	PU2	0.76			
	PU4	0.80			

Constructs	Items	Factor loading	CR	AVE	Cronbach's alpha
PA	PA2	0.75	0.85	0.66	0.958
	PA3	0.79			
	PA4	0.89			
PC	PC1	0.73	0.83	0.62	0.920
	PC2	0.75			
	PC4	0.88			
C	C1	0.72	0.85	0.65	0.618
	C2	0.83			
	C3	0.87			

Table 7. Discriminant validity.

Constructs	PU	PEOU	PC	C	PA	BI
PU	0.63					
PEOU	0.59	0.69				
PC	0.48	0.40	0.70			
C	0.41	0.32	0.49	0.65		
PA	0.33	0.28	0.55	0.45	0.73	
BI	0.28	0.36	0.46	0.53	0.59	0.75

Table 8. Values of fit indices.

Absolute fit measure							Parsimonious fit measure	Incremental fit measure
	CMIN	Do	CMIN/Df	GFI	RMSEA	AGFI	CFI	NFI
Acceptable fit			<3	≥0.90	<0.5	≥0.09	≥0.90	≥0.90
Obtained fit MM	320.110	290	1.103	0.920	0.03	0.911	0.930	0.929
Obtained fit SM	318.010	290	1.097	0.921	0.03	0.90	0.931	0.930

5.2 Structural model

The relationships of the hypothesis are explained using the structural model. The outcomes of structural model indicate that seven hypotheses (H1, H1a, H2, H3, H3a, H4 and H5) are accepted as presented in Table 9. Conversely, hypothesis H1a is not supported. The result for each hypothesis is discussed below.

H1: C → PU, H1a: C → PEOU: The achieved value of the critical ratio of H1 is higher than the recommended value (1.96), which results in the support of H1 ($\beta = 0.321^{***}$, CR = 7.433 and P = 0.001), representing the significant effect of C on PU for EHA. These results are in line with existing studies (Bhattacherjee, 2001; Weng et al., 2017), However, besides that, the second hypothesis of the effect of C on PEOU is strongly rejected, while it was supposed to be a strongly accepted hypothesis. The statistics show that H1a has ($\beta = 0.065$, CR = -0.213), proving a strong rejection of the proposed hypothesis. As it was seen that people in the KSA like to use the application without looking at its ease of use, and as the data were collected from educated persons, it is considered that people appreciate usefulness more than ease of use. Furthermore, due to lesser acceptance of public transport and fewer female drivers in the society, confirmation is very important in the promotion of the use of EHA. However, in most of the studies, it

was accepted with higher significance (Bhattacherjee et al., 2008; Hong et al., 2006; Lin et al., 2007; Thong et al., 2006).

H2: PA → PEOU: A strong and significant relation of PA on PEOU was determined with a CR value above the threshold, i.e., 1.96, and the obtained statistics are also in favour of the acceptance of H2 with (β = 0.291**, CR = 4.546 and P = 0.01). Hence, on the basis of the achieved results, it can be inferred that PA has a strong influence on PEOU. This finding of our work is also in line with an existing study (Rafique et al., 2018).

H3: PEOU → PU, H3a: PEOU → BI: Hypothesis H3 claims the effect of PEOU on PU and hypothesis H3a supposes a significant effect of PEOU on BI. However, if we look at the derived results, it is evident that both hypotheses have a positive influence on their dependent variables. The critical ratio value of both hypotheses is higher than the threshold values and the estimated results for hypothesis H3 are (β = 0.382***, CR =6.654 and P = 0.001), supporting our hypothesis H3; the results for H3a are (β = 0.306***, CR = 5.060 and P = 0.001) with significant results towards the dependent variable. Categorically, the attained outcomes are backing preceding work (Azmi et al., 2016; Joia & Altieri, 2017; Sinaga & Hendayani, 2015; Y. Wang et al., 2018).

H4: PU → BI: Hypothesis H4, which states the relationship of PU on BI, is also proved significant with the critical ratio higher than the threshold value and the achieved results for PU on BI with (β = 0.300***, CR = 5.169 and P = 0.001). Hence, by looking at the results, we can say that the proposed hypothesis is greatly supported and the results also support the prior research with strong significance (Park & Kim, 2014; Y. Wang et al., 2018).

H5: PC→ BI: Our last hypothesis states that perceived convenience will have a strong influence on BI. It is also proved with strong significance from the obtained results (β = 0.344***, CR = 4.439 and P = 0.001). The strong relationship of the proposed hypothesis is also proved with a high critical ratio value. Therefore, the results are similar to existing results from a prior study (Teo et al., 2018).

Table 9. *Hypothesis testing.*

Hypothesis	β-value	t-value	Status
H1: C → PU	0.321***	7.433	Accepted
H1a: C → PEOU	0.065	-0.213	Rejected
H2: PA → PEOU	0.291**	4.546	Accepted
H3: PEOU → PU	0.382***	6.654	Accepted
H3a: PEOU → BI	0.306***	5.060	Accepted
H4: PU → BI	0.300***	5.169	Accepted
H5: PC → BI	0.344***	4.439	Accepted

6 Contributions and Implications

Theoretical contributions and practical implications of the study are presented in this section.

6.1 Theoretical contributions

The theoretical contributions of the study are manifold. This work contributes to the transport sector by identifying and examining the influencing factors of EHA acceptance and adoption. The work extends the literature on transport service research by proposing and empirically validating a theoretical research model to understand users' acceptance of EHA. This study provides a deeper understanding of the influencing factors in the adoption of EHA in the context of Saudi Arabia. The insightful relationships reported in this work between the influencing factors enrich the body of knowledge in the area of users'

perception of new technologies and applications. Theoretical breadth and depth have been attained by including external factors in TAM. This work may guide researchers to understand and apply these factors in similar environments. Also, the theoretical contributions of the study present a significant reference to examine the acceptance of EHA in different contexts and different situations. Additionally, the proposed model can be tailored to investigate the adoption of new technologies in the transport sector and other sectors as well. In addition, the results assist in making policies for users of EHA.

6.2 Practical implications

The study presents several practical implications for users, developers and policymakers of EHA. The study highlights significant factors in the adoption of EHA by their users. This would lead to understanding the barriers to the popularity of these applications. Understanding these barriers will provide a way to improve existing EHA to promote their popularity and usage among users. The empirical findings of the study can contribute to the development of new guidelines for EHA. The crucial factors highlighted in the study should be addressed by developers of new applications to increase their adoption by users. One crucial factor is confirmation of the expectation that has an influence on PU, requiring significant attention. The findings suggest a direct relationship between PC and behavioural intention; hence, EHA need to deliver convenience to customers. Failing that, customers may favour other transport modes. This study recommends developers of EHA to give adequate importance to C, PC and PA as these factors affect BI. The developers may focus on PU to improve the usage of EHA. The increased adoption of EHA can be achieved by enhancing C, PA, PC, PEOU and PU factors. C, PA and PC should be targeted to increase the number of female users as these factors are of prime importance for female users especially in Saudi Arabia and other countries having less or no public transport.

7 Conclusion, Limitations and Future Directions

With the increased use of the Internet and lower acceptance of public transport, the use of EHA is also increasing in Saudi Arabia. Convenient transport services at the doorstep are a requirement in Saudi Arabia due to lower acceptance of public transport. This work provides insight into the usage intention of EHA in the context of Saudi Arabia as there are multiple factors that affect the intended behaviour of users. The outcomes of the study assisted in proposing new guidelines for the designers and developers of EHA. The findings justify that C, PA, PC, PEOU and PU influence the adoption of EHA. Consequently, developers and designers of EHA need to be concerned about these factors. This study also has a few limitations. Most importantly, the study was conducted in the context of Saudi Arabia, which limits its generalizability. The findings of this work cannot be applied to other contexts due to the difference between IT infrastructure and growth of Saudi Arabia and those of other countries. The study respondents were mostly young and technology-aware people. The older adult groups may have a different perspective and will be targeted in the future. Future research may be targeted to investigate the influence of other external factors on usage and adoption of EHA.

Additional Information and Declarations

Conflict of Interests: The authors declare no conflict of interest.

Author Contributions: M.A.Q: Conceptualization, Methodology, Writing – Reviewing and editing. A.S.: Data curation, Writing – Original draft preparation.

Data Availability: The data that support the findings of this study are available from the corresponding author.

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